

# INTEGRATED STUDY OF ALTERNATIVES FOR VALDEVAQUEROS DUNE AREA (Tarifa Co., Cadiz, Spain)

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## INTRODUCTION

Causes of dune degradation in Spain have been analyzed by various authors: Gómez-Pina (1999), Gómez-Pina et al (2002). Dune ecosystem problems in Cadiz have been studied by Ramírez and Ley (1998), Muñoz-Perez et al (2001) and Navarro et al (2004) with especial incidence in the mobile dunes of Valdevaqueros and Bolonia (Tarifa Co.).

Before 1988, Spanish coastal dunes were totally unprotected. The 1988 Spanish Shore Act ("Ley de Costas") arose with the aim of regulating the coastal activities and preventing littoral destruction. The Spanish Shore Act protects all coastal dunes, effectively banning sand-mining, development on the public domain, and also changes in land uses. However, this law alone does not prevent some other negative activities from occurring. Furthermore, the complexity of existing boundaries of the different authorities involved in coastal zone management policy makes integrated dune management a difficult task.

The special characteristics of Valdevaqueros dunes together with their natural and scenic values confer to Valdevaqueros cove a great attraction. The frequent local Levante wind regimes give rise to high wind speeds of up to 100 km/h (a paradise for flying-surfers). The high longitudinal aeolian transport is responsible for building up a huge mobile dune at the northern beach side. Wind conditions and low rainfall, together with the direct burden caused by dune visitors, make it difficult to establish permanent vegetation on the dune. As a result the dune becomes unstable, showing a continuous massive movement towards an adjacent pine grove and the local Punta Paloma road. Before 1988, when dune sand mining was a profitable business, the mobility of Valdevaqueros dunes was relatively well controlled and the adjacent local road rarely was blocked by the mobile dunes. However, the frequency and high velocities of Levante winds make it very difficult and costly to maintain the adjacent local road cleared.

Dune restoration works started with the reshaping of the dune profile in order to obtain a better aerodynamic stability complimented with the experimental use of wooden fences to decrease erosive surface patterns. Also experimental transplanted vegetation techniques were used along certain potentially stable areas. These experimental dune works have been carried several times in order to lessen the frequency of the occupation of the local Punta Paloma road by the mobile dunes, still an unsolved "problem". Controlled sand bypassing operations with the remaining sand have been used beneficially to nourish some beaches in Tarifa County.

## OBJECTIVE

The main objective of this paper is to present an integrated study of alternatives for Valdevaqueros dune area, considering all the problems involved: dune degradation, invasion of Punta Paloma road by the mobile dunes, excessive recreational pressure on the dune area and adjacent lagoon, parking lots resettlements, and undesirable land uses in the surroundings, among the most important problems found in that area. In particular, a cost-benefit analysis for different alternatives was carried out regarding the road-dune interaction. Figures 1 and 2 shows an aerial view of Valdevaqueros cave and the occupation of Punta Paloma road by the mobile dunes respectively.



Figure 1.- Aerial view of Valdevaqueros cave



Figure 2.- Occupation of Punta Paloma road by Valdevaqueros mobile dunes.

The least costly alternative analyzed was the one consisting of designing a new road connecting Punta Paloma local road with the main road. In that way the mobiles dunes could have a more sustainable stabilization. Nevertheless, this alternative is still under consideration by Tarifa Town Hall and Punta Paloma military headquarters.



## REFERENCES

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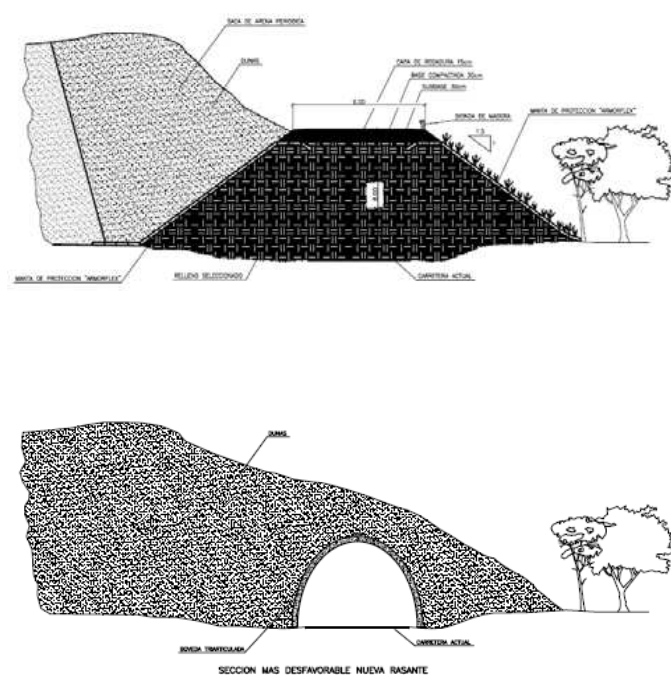


Figure 3 .- Some alternatives related to dune-road interaction

